Docket # 71084

BALL-AND-SOCKET JOINT

RELATED APPLICATION

This application is a continuation of application no. 09/700,598 filed November 16, 2000.

FIELD OF THE INVENTION

The present invention pertains to a ball-and-socket joint with a housing, a bearing shell inserted into the housing, a ball pivot with a joint ball mounted in the bearing shell movably in all directions, and a sealing bellows between the housing and the ball pivot.

BACKGROUND OF THE INVENTION

Such ball-and-socket joints are used, e.g., for wheel suspensions of motor vehicles. The general design is almost always the same. For example, prior-art ball-and-socket joints comprise a housing and a bearing shell inserted therein. The bearing shell receives, with its inner spherical bearing surface, the joint ball of a ball pivot movably in all directions. To seal the ball-and-socket joint components, which are movable in relation to one another, against the environment, a sealing bellows is inserted between the housing and the ball pivot.

A ball-and-socket joint of this type is shown, e.g., in DE 36 32 265 C1. The sealing bellows arranged between the housing and the ball pivot is fixed with its pivot-side edge area on the ball pivot only partially in a retaining ring having an L-shaped cross section. The drawback of a design according to DE 36 32 265 C1 is, however, that the fixed sealing bellows is directly in contact with its outer surface with the motor vehicle component and friction is thus generated during movements of the ball-and-socket joint as a consequence of the relative movement between the sealing bellows and the motor vehicle component, and this friction damages the surface of the sealing bellows and compromises the sealing function of the bellows over a long life cycle or destroys the bellows altogether. This implies the risk that the sealing bellows will age and will be worn prematurely and the joint as a whole may thus possibly fail.

Moreover, a retaining ring, which is arranged tightly on the ball pivot and slidingly receives the edge of the sealing bellows, has been known from SUI-PS 465 971.

SUMMARY AND OBJECTS OF THE INVENTION

The basic technical object of the present invention is to design the component pair "ball pivot-sealing bellows" such that compensation of the movements generated in the joint is made possible with the slightest friction possible without the sealing bellows becoming worn or destroyed.

According to the invention, a ball-and-socket joint is provided comprising a housing, a bearing shell inserted into same, a ball pivot, whose joint ball is mounted in the bearing shell movably in all directions, and a sealing bellows between the housing and the ball pivot. A sliding ring receiving the pivot-side edge area of the sealing bellows is slidingly inserted into a ball race fixed on the ball pivot.

The present invention consequently provides a ball race seated tightly on the ball pivot. The sliding ring receives the pivot-side edge area of the sealing bellows and is slidingly received in this ball race.

A friction-optimized pairing, which receives the edge area of the sealing bellows and thus makes possible the compensation of all the movements performed by the sealing bellows in the ball-and-socket joint without destruction of or damage to the sealing bellows, is achieved between the ball race and the sliding ring due to a solution according to the present invention.

In another embodiment of a ball-and-socket joint according to the present invention, the inner side of the sliding ring cooperating with the edge area of the sealing bellows is provided, at least in some areas, with a collar. This collar is preferably made in one piece with the inside of the sliding ring, so that this can be manufactured as a one-piece component. The collar in

turn engages a complementary contour in the edge area of the sealing bellows. As a result, a "clamping effect" is achieved in a simple and advantageous manner. This clamping effect presses the edge area of the sealing bellows against the ball race under pretension, so that sufficient sealing is also guaranteed at the same time, besides the sliding function of the edge area of the sealing bellows. The sliding ring may have an approximately L-, T- or F-shaped cross section.

To reduce the sliding friction between the sliding ring and the ball race, it is, moreover, suggested according to the present invention that if a sliding ring having an approximately L-shaped cross section is used, which correspondingly comprises an axial leg and a radial leg, a sliding connection be established only between the radial leg and the inner surface of the ball race. There is a gap between the axial leg and the inner surface of the ball race, which inner surface is associated with the axial leg. Due to such a solution only very small surfaces are in contact with one another, which makes it possible to specifically influence the friction parameters. The ball race may in turn have a U-shaped or likewise L-shaped cross section. Depending on the requirements on the sliding friction partners and the sealing of the entire system, it is, moreover, possible for at least one surface of the edge area of the sealing bellows to be directly slidingly in contact with the inner surface of the ball race. Corresponding to the solution being presented here, this contact pairing may comprise a sealing lip of the edge area of the sealing bellows or it may be a labyrinth seal formed with the inner surface of the ball race.

The labyrinth seal, between the inner surface of the ball race and the edge area of the sealing bellows, as well as the sealing lip, are alternative solutions, which may, of course, also

be used together. This means that, e.g., a surface of the edge area of the sealing bellows has a sealing lip, and this sealing lip acts against the inner surface of the ball race, and another, second surface of the edge area of the sealing bellows forms a labyrinth seal together with the inner surface of the ball race. The sliding ring now assumes the function of pretensioning the edge area of the sealing bellows in the corresponding axial or radial direction against the surface to be sealed. A reduced diameter of the sealing bellows may have a supporting effect in this case. The sliding ring may be manufactured as a shaped sheet metal part or plastic molding in a simple manner and inexpensively. This also applies to the ball race.

According to another embodiment, the sliding ring may have according to the present invention at least one slot. In the case of a slotted design of the sliding ring, the sliding ring is briefly widened during mounting and is subsequently snapped into the ball race.

In another embodiment according to the present invention, the ball race has lugs located at spaced locations from one another. The sliding ring is pushed onto the ball race in such an embodiment, the lugs of the ball race are subsequently deformed in the radial direction and thus they receive the sliding ring together with the edge area of the sealing bellows within the ball race.

Sealing of the component pairing "ball pivot-sealing bellows" can be achieved with a ball-and-socket joint according to the present invention in the obvious manner in the axial direction, in the radial direction as well as in the axial and radial directions. For reasons of stability, it is advantageous here for the pivot-side edge area of the sealing bellows to form a thickened material bead, which acts with an elastic pretension against the ball race and/or

against the sliding ring. Reduced friction was achieved with a ball-and-socket joint according to the present invention between the sealing bellows and the ball pivot. The sealing bellows can no longer twist during movements of the joint and is therefore also not worn and destroyed as a consequence of the harmful tensile stresses generated by the twisting, unlike in the case of the prior-art designs. The pretension between the sliding ring and the ball race can be selected in a very simple manner and accurately, so that the friction parameters and consequently the behavior of the friction partners can be accurately predetermined.

The sliding ring can thus form both a detachable connection with the edge area of the sealing bellows and be vulcanized directly on the edge area of the sealing bellows or be fastened to this edge area in the known manner or be integrated in this edge area.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its uses, reference is made to the accompanying drawings and descriptive matter in which preferred embodiments of the invention are illustrated.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

Figure 1 is a sectional view showing an embodiment of the component pairing ball pivot-sealing bellows edge area according to the present invention;

Figure 2 is a sectional view showing another embodiment of the component pairing ball

pivot-sealing bellows edge area according to the present invention;

Figure 3 is a detail sectional view along line III-III according to Figure 1;

Figure 4 is a detail sectional view along line IV-IV according to Figure 6;

Figure 5 is a sectional view showing another embodiment of the component pairing ball pivot-sealing bellows edge area according to the present invention;

Figure 6 is a sectional view showing another embodiment of the component pairing ball pivot-sealing bellows edge area according to the present invention;

Figure 7 is a sectional view showing another embodiment of the component pairing ball pivot-sealing bellows edge area according to the present invention;

Figure 8 is a detail sectional view along line VIII-VIII according to Figure 7;

Figure 9 is a sectional view showing another embodiment of the component pairing ball pivot-sealing bellows edge area according to the present invention; and

Figure 10 is a partial sectional view of the ball joint.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings in particular, a ball pivot 3 has a joint ball 3.1 inserted into a housing 1 having a bearing shell 2 to form the ball-and-socket joint. A ball race 5 of U-shaped cross section is placed on the ball pivot 3. The snug fit of the ball race 5 on the ball pivot 3 is preferably achieved by means of a force fit. A sliding ring 6 of L-shaped cross section is inserted into the ball race 5 having a U-shaped cross section. The sliding ring 6 has an axial extension formed as an axial leg 6.3 and a radial extension formed as a radial leg 6.4. The edge

area 4.1 of the sealing bellows 4 is received between these legs. A surface of the edge area 4.1 of the sealing bellows 4 is in direct sliding contact with the inner surface of the ball race 5. This connection represents a labyrinth seal 4.3, 5.1 at the same time. On the contact side of the radial leg 6.4 of the sliding ring 6, the ball race 5 has lugs 5.2. These lugs, directed in the axial direction before the mounting of the sliding ring, are deformed after the insertion of the sliding ring 6 into the ball race 5, so that a sliding pair is formed between the ball race 5 and the sliding ring 6.

Figure 2 shows once again a component pairing between the ball pivot 3 and the edge area 4.1 of the sealing bellows, which has essentially the same design as that shown in Figure 1. However, the sliding ring 6 with its axial leg 6.3 is not in sliding contact with the inner surface of the ball race 5 in the embodiment according to Figure 2 according to the present invention. There is rather a gap 7 between the axial leg 6.3 of the sliding ring 6 and the inner surface of the ball race 5. The sliding ring 6 is thus in contact with the lugs 5.2 of the ball race 5 with its radial leg 6.4 in some areas only. The surfaces between the ball race 5 and the sliding ring 6, which surfaces are in contact with one another, are very small in such a design, so that a considerable reduction in friction can be achieved hereby.

The embodiments of a ball-and-socket joint according to the present invention shown graphically in Figures 5 and 6 have some peculiarities. Thus, the ball race 5 and 5A has again a U-shaped cross section, but the sliding ring 6A has a disk-shaped design in the embodiment of Fig. 5. The axial extension is formed as a collar 6.1 is made in one piece with the sliding ring 6A approximately centrally on the side facing the edge area 4.1 of the sealing bellows 4A. This

collar directly engages the edge area 4.1 of the sealing bellows 4A and thus makes it possible to press the edge area against the inner surface of the ball race under pretension. Furthermore, the edge area 4.1 of the sealing bellows 4A has a sealing lip 4.2, which is in contact with a first inner surface of the ball race 5/5A and assumes a sealing function during movements of the sealing bellows as a consequence of its stripping effect. Moreover, a wave-shaped contour 4.3 is provided on another surface of the edge area 4.1 of the sealing bellows 4A. This wave-shaped contour 4.3 cooperates with an inner surface 5.1 of the ball race 5/5A, which said inner surface 5.1 has a complementary shape and forms a labyrinth seal 4.3, 5.1.

In the embodiment according to Figure 6, the sliding ring 6A is additionally slotted. This means that it is snapped onto the ball race 5A during the mounting. This is shown in the section IV-IV from Figure 6, which is shown in Figure 4. The section III-III corresponding to Figure 1 is shown in Figure 3. The lugs 5.2 can be recognized here.

As can be recognized from Figures 1, 2, 5 and 6, both the ball race 5/5A and the sliding ring 6 or 6A may be manufactured optionally from metal or plastic or metal-plastic composites.

The variant of a ball-and-socket joint according to the present invention as shown in Figure 7, which has basically the same design as the embodiments shown in Figures 5 and 6, has the difference that the sliding ring 6B consists of a sheet metal part manufactured by shaping and embossing. The connection of this sliding ring 6B to the ball race 5 is shown in the sectional view in Figure 8 corresponding to the section VIII-VIII from Figure 7. Lugs 5.2 of the ball race 5 are again used in the above-described manner to fix the edge area 4.1 of the sealing bellows 4A as well as the sliding ring 6B. The collar 6.1A is formed by a material fold.

Figure 9 shows still another embodiment of the component pairing ball pivot-sealing bellows edge area according to the present invention. A ball race 5 of U-shaped cross section is placed on the ball pivot 3. The snug fit of the ball race 5 on the ball pivot 3 is preferably achieved by means of a force fit. A sliding ring 6 of L-shaped cross section is inserted into the ball race 5 having a U-shaped cross section. The sliding ring 6 has an axial leg 6.3 and a radial leg 6.4. A collar 6.1 is made in one piece with the sliding ring 6 approximately centrally on the side facing the edge area 4.1 of the sealing bellows 4. This collar directly engages the edge area 4.1 of the sealing bellows 4 and thus makes it possible to press the edge area against the inner surface of the ball race under pretension. The edge area 4.1 of the sealing bellows 4 is received between these legs. A surface of the edge area 4.1 of the sealing bellows 4 is in direct sliding contact with the inner surface of the ball race 5. This connection presents a labyrinth seal 4.3, 5.1 at the same time. On the contact side of the radial leg 6.4 of the sliding ring 6, the ball race 5 has lugs 5.2. These lugs, directed in the axial direction before the mounting of the sliding ring 6, are deformed after the insertion of the sliding ring 6 into the ball race 5, so that a sliding pair is formed between the ball race 5 and the sliding ring 6.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.